Disaster monitor

AFP, BENJAMIN EVANS

On the spot: Soldiers evacuate flood victims during the 2012 Queensland floods

Sentinels up in space

By **JACK SCOTT***

AS Queenslanders raced to higher ground and battled to preserve lives and property during the floods of 2010 and 2011, sentinels in space were helping experts monitor the disasters.

During the worst of the storms, the only way to detect the severity and extent of damage due to flooding was space-based synthetic aperture radar (SAR). There were no other wide area imaging sources that could provide this information: neither aircraft sensors (not able to fly in severe weather) nor optical satellites (hindered by extensive cloud cover).

The Italian COSMO SkyMed imaging satellites came to the rescue using their day/night cloud penetrating SAR. They were cued to image the flood area every 24 hours. Italian imagery organisation, eGEOS, provided these images to the dedicated team of scientists at the University of New South Wales who, in collaboration with Land and Property Information, NSW, were monitoring the unfolding disaster.

This team was able to capture four to six images per day during the peak of the storms. The images were processed day and night, generating maps which were forwarded to State Emergency Services. These maps were critical to the rescue and recovery effort.

Overall, COSMO SkyMed provided more than 200 images from its constellation of four satellites during the 2010 and 2011 floods.

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Earth observation

Picture perfect

Information about our blue planet gathered by satellites adds millions to the nation's GDP and saves lives, too. **LAURA CENCIGH-ALBULARIO** *reports*

WHILE the early days of Earth observation from space were mostly in the realm of science and research, there is now a rapid shift towards more immediate, operational roles.

From guiding disaster response efforts to mining exploration, weather and climate change monitoring, Earth observation from space (EOS) plays a vital role in Australia's landscape. It's also a lucrative one, with the EOS sector estimated to have directly contributed $1.4 billion to Australia's GDP between 2008 and 2009, according to a report compiled by ACIL Tasman for the Cooperative Research Centre for Spatial Information and Geoscience Australia. Adding in broader productivity benefits and costs avoided thanks to EOS brings the total GDP contribution to at least $3.3 billion.

The CSIRO terrestrial Earth observation team leader, Dr Alexander Held, says the next wave of technology to be rolled out by NASA, Germany and Japan in the coming years will ramp up the value to the mining sector.

"The new technology has an extremely high ability to detect minerals and there is much interest in it from the perspective of mining exploration," Dr Held says. Two of these satellites are already in space, but are currently being used mostly as research tools. "From 2014, through the following decade, we are expecting to see a massive increase in the quality of satellite data for mineral mapping," he says.

The new satellites work mostly through measuring the reflectance of light frequencies: "By understanding what type of light is reflected back from different minerals, the information can be used to fingerprint different minerals and chemicals." Other satellite measurements use magnetic and gravitational fields to detect geological properties deeper in the ground.

Along with seeking out new opportunities, advances in satellite technology are also improving their capacity to help manage disasters.

Since last year, a $4.7 million joint research project run by the Australian Centre for Space Engineering Research (ACSER) has been working on the technology for a constellation of Synthetic Aperture Radar (SAR) spacecraft that can image the Earth at night and in any weather. According to the ACSER director, Professor Andrew Dempster, some of the applications for this technology include mapping the outlines of floods and fires in real-time.

"If it's raining, there will be clouds; and if there's fire, of course you've got smoke. And sometimes fire causes clouds, too, so you need something that will see through these obstructions," Prof Dempster says. "With flood mapping, emergency services will use the information to look at flood extent and know who to rescue and when to evacuate people."

As the technology develops further, Prof Dempster believes it will have clear advantages over aerial surveillance.

"When you've got smoke or bad weather, it's dangerous to fly a plane – and it's expensive to own and operate a plane. Then you've got different states operating different equipment. Satellite technology is expensive to build and launch but, once it's there, it's there; there's not a lot to maintain," he says.

The disadvantage is frequency, Prof Dempster admits, as satellites can't fly over the same area every hour.

"You have to task the satellite to do the job, wait until they get to the right place. After the job is done, they must fly along their orbit until they reach the ground station to download the information. Once it's downloaded, the data gets sent over the internet for processing. It's not fully automated, so then there's a human factor involved," he says.

However, image frequency can be sped up considerably when there are constellations of satellites following each other.

In another major field of Earth observation, climate change and landscape monitoring, it's long-term consistency, rather than frequency that's the key. For example, the Federal Government-funded Terrestrial Ecosystem Research Network (TERN) is working on a series of satellite data sets aimed at helping ecological scientists and other researchers around Australia track the landscape's response to various factors, such as droughts and fires. This project, which began in 2009, is expected to start releasing these data sets by 2014.

More broadly, CSIRO's Dr Held says some of the satellites the organisation has been using have been collecting daily images for 40 years.

"With a bit of computer processing, we're able to build a history of the continent and track changes in the landscape – it has become an extremely valuable tool," he says.

RENEE NOWYTARGER

Where there's smoke: Maps of fire and flood outlines guide emergency services

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>
> **GRANT WARDELL-JOHNSON**
> Director of Curtin Institute for Biodiversity and Climate

The director of Curtin Institute for Biodiversity and Climate, Associate Professor Grant Wardell-Johnson, agrees.

His department relies heavily on satellite technology in their research and he says environmental monitoring has become increasingly vital now that humankind's impact on the planet is intensifying.

"We live in times of incredibly rapid change in many areas – not just climate change. Also cities are changing, land use and populations are changing," he says.

"There are really big transformational changes happening on every continent and in every country, all around the planet."

Prof Wardell-Johnson compares the efficiency of satellite imagery for environment monitoring with the old days of using plot-type work, maps and aerial photographs to build a picture of landscapes over time.

"Having to return to plots over time is incredibly expensive," he says. "Ground work is still important as you need to identify individual plants and animals, but if you can link up that work with satellite imaging and see the same sort of patterns in satellite imagery for other patches of ground, you can make assumptions about other plots.

"There wouldn't be the possibility to have an understanding of the whole continent over time without satellite."